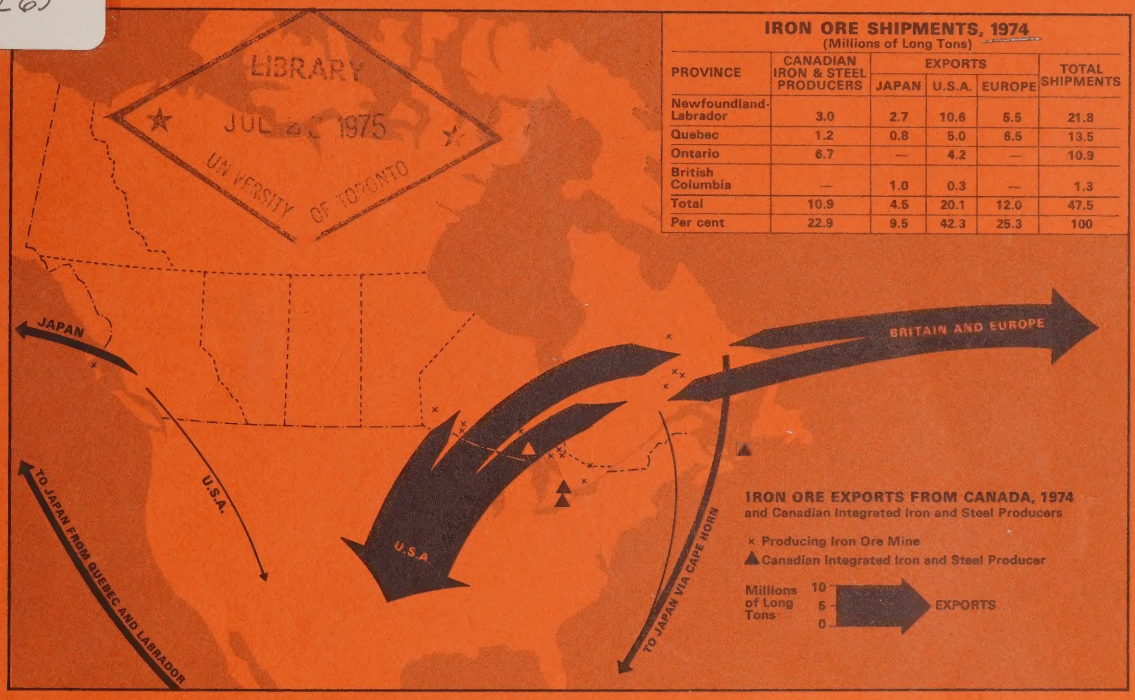
Energy, Mines and Resources Canada / Énergie, Mines et Ressources Canada

IRON ORE IN CANADA

IRON ORE SHIPMENTS, 1974
(Millions of Long Tons)

PROVINCE	CANADIAN IRON & STEEL PRODUCERS	EXPORTS			TOTAL SHIPMENTS
		JAPAN	U.S.A.	EUROPE	
Newfoundland-Labrador	3.0	2.7	10.6	5.5	21.8
Quebec	1.2	0.8	5.0	6.5	13.5
Ontario	6.7	—	4.2	—	10.9
British Columbia	—	1.0	0.3	—	1.3
Total	10.9	4.5	20.1	12.0	47.5
Per cent	22.9	9.5	42.3	25.3	100



Iron Ore in Canada

Iron is found near the surface of the earth combined with other elements. These combinations constitute the iron minerals, such as hematite or magnetite. Hematite, which is 70 per cent iron, is one of the important iron ore minerals.

In Canada, Newfoundland (Labrador), is the largest iron ore producer, followed by Québec, Ontario and British Columbia. Canada ranks among the top six in world production and exports of iron ore.

Iron ore, along with copper and coal, was one of the first minerals mined in Canada. About 1670, deposits were found in the swampy areas near Trois-Rivières, Québec. By the 1740s Canada's first ironworks, Les Forges de Saint-Maurice at Trois-Rivières, was turning out top-quality cast iron stoves, pots, kettles, bullets and cannon to serve the needs of the pioneer settlers. It is interesting to note that iron smelting and casting were this country's first industrial undertaking, and today the manufacture of steel is one of Canada's few major industries that is largely Canadian-owned.

Development of the Industry

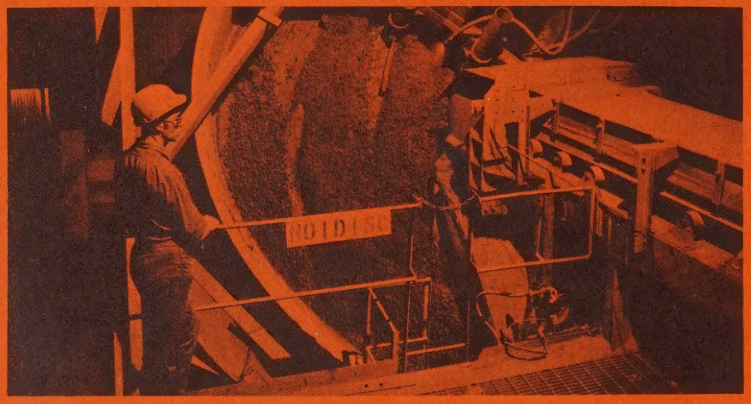
By 1969, iron ore was produced by 16 companies at 17 locations with Newfoundland (Labrador) the largest producing province, followed by Québec, Ontario and British Columbia. Today the Iron Ore Company of Canada is the country's largest iron ore mining company, followed by Québec Cartier Mining Company. Wabush Mines is third

largest. The high degree of diversification of the Canadian iron ore industry is illustrated by its production of 40 different kinds and grades of ore.

Iron is the main element in steel – the metal so basic to industrial society. The manufacture of steel in Canada dates from the 1870s when there were many small manufacturers of steel and steel products across the country, but it was not until about 1900 that the industry in its modern form emerged. A fully-integrated Canadian steel industry, covering all aspects from mining the ore to marketing steel products, dates from 1939 when the Algoma Steel Company brought its Helen Mine into production at Michipicoten, Ontario.

Today the Canadian iron and steel industry embraces several dozen firms, but only four are "integrated" producers in the sense that they operate coke ovens (to produce coke from coal for the smelting process), blast furnaces, steel furnaces, and rolling mills. These four large producers are: DOSCO – Dominion Steel and Coal Corporation at Sydney, N.S.; Algoma Steel Corporation Limited, Sault Ste. Marie, Ontario; STELCO – The Steel Company of Canada, Limited, and DOFASCO – Dominion Foundries and Steel Limited, both at Hamilton, Ontario.

Overall view of open-pit iron mine: South Roberts Mine, Steep Rock Iron Mines Ltd., Steep Rock Lake, Ontario.



Rotating disc which forms iron pellets.

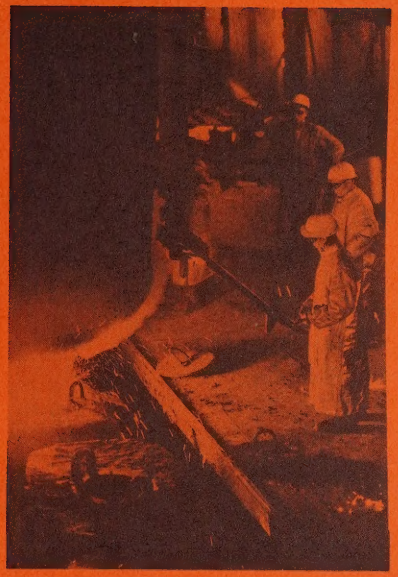
From Mine to Manufacturer

Because iron ore is generally found close to the surface of the earth, it is usually extracted from *open-pit mines*. First overlying rock and soil are blasted and bulldozed away. Holes are then drilled into the orebody, and explosives placed in them. Blasting shatters the orebody, and huge mechanical shovels scoop the ore from the mine face, cutting steps or benches into the side of the deposit. Their loads are dropped into waiting trucks that carry up to 100 tons of rock to the crushing plant.

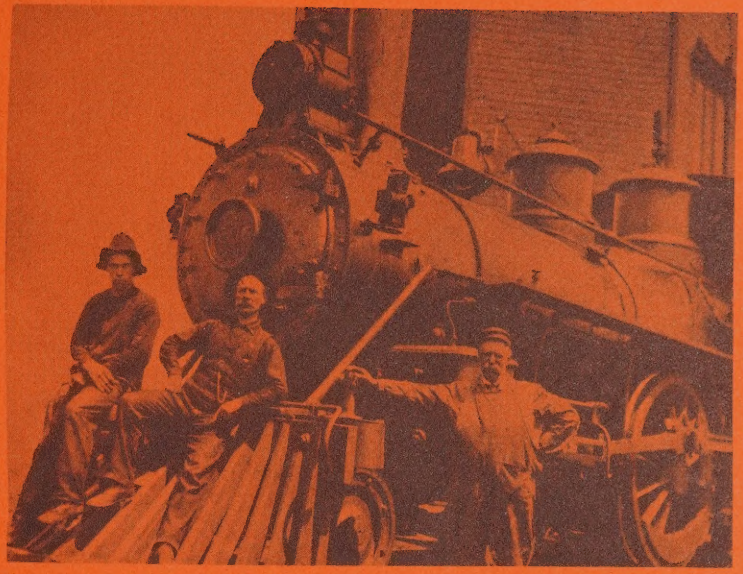
The processing of crude iron ore begins with a series of *beneficiation processes* to separate the iron ore from waste rock. The crude ore is crushed, then ground into a cinder-like iron *concentrate*. Finally the concentrate is baked and pressed into hard *pellets*. In this form the ore is hard enough to withstand the crushing pressure of the blast furnace. An important factor in the growth of iron ore's use has been the development of pelletizing to provide a high grade furnace feed for steel plants, thus increasing the efficiency of the blast furnace operation.

Making pig iron is the first step of the steelmaking process. Appropriate amounts of iron, coke and limestone are *smelted* in towering vertical shafts called blast furnaces. The raw materials are fed in alternate layers through the top of the furnace into a blast of superheated air that causes them to melt and react. The resulting molten pig iron is drawn off at the bottom of the furnace. When cooled, pig iron may be cast into bars and used to manufacture many industrial products including machinery components, hardware and small tools. Pig iron or *cast iron* contains various impurities such as carbon, silicon, sulphur and manganese. While cast iron has the advantages of being easily melted and cast into intricate shapes, it is a relatively brittle material. Steel, on the other hand, is characterized by its toughness.

Molten pig iron to be used in steelmaking is combined with scrap



Molten metal is drawn off the bottom of the furnace in the smelting process.



The "iron horse" of yesteryear: CPR Engine #206, 1905. (Public Archives of Canada photo)

and moved to an oxygen furnace where it is transformed to steel in less than an hour. In this process oxygen is blasted into the furnace, burning out impurities. Next the steel is ladled into moulds. When cool the mould is removed, yielding an ingot, the first solid form of steel. These ingots are processed further into rectangular billets and slabs, and finally rolled into rods, bars, sheets and plates – raw material for the many steel products we depend on daily.

Uses of Iron and Steel

A little over a hundred years ago iron was the universal industrial material. It was considered the ultimate in strength and modernity. In North American homes box iron stoves replaced the fires of hearth and grate as a means of cooking and heating. Streets were adorned with ornate iron gas lamp standards, lawns and squares enclosed by decorative iron railings, and rooftops sprouted the iron points and curlicues that have come to symbolize the quaint excesses of Victorian architecture. The railroad era brought the "iron horse" that carried goods and settlers to the outposts of the infant Canadian nation. And, then of course came the automobile.

The most spectacular and revolutionary use of iron, and then steel, was in the construction of bridges and buildings. In the latter half of the 19th century new methods of steelmaking made steel cheap and plentiful. Structural steel became commercially available in the 1880s, and was readily adapted to the builder's needs. The advent of the steel skeleton frame, with exterior "curtain" walls of glass and metal, released building construction from the height limitations imposed by the thick masonry walls used in the past. In 1885 Chicago boasted a 10-story building with a structural frame of wrought iron and steel – forerunner of the modern skyscraper. Four years later Paris produced the Eiffel tower, the wonder of its time and highest man-made structure in the world for the next 40 years. Iron and steel changed the face of the world in a single generation. Without the development of steel, the world would still look much the way it did in the mid-1800s. Buildings, bridges, automobiles, appliances – steel is the most widely used metal today.

Production and Markets

The growth and changing pattern of international trade in iron ore are closely interwoven with developments in the iron and steel industry. Historically, large steel industries were established in areas where the two primary materials, iron ore and coking coal, occurred close together. Examples are the Ruhr Valley in Germany, Lorraine in France, the English Midlands, and Pennsylvania in the United States.

Since the 1950s, however, fewer steel-producing nations have remained totally dependent on their own raw materials. It has become cheaper to assemble raw materials from distant points by long-distance ocean transport, while the demand and price for steel continue to rise. Also, some traditional domestic reserves of high-grade iron ore are becoming depleted, and steel manufacturers are supplementing domestic supplies with the high-grade ores of new producer countries.

Of the five major steel-producing regions of the world – the United States, Western Europe, Britain, Japan and the USSR – only the USSR has enough iron ore for its

The "Arafura Maru", docked at Sept-Îles, Québec, will head for Japan carrying 152,920 tons of iron concentrate. The 180,000-ton carrier is one of the biggest ever to dock in the St. Lawrence.

needs. Japan, at the other extreme, is practically without domestic resources at all. For its part, Canada imports less than five million tons of iron ore a year to partially fill the needs of the steel industries of Ontario and Nova Scotia. The bulk of the ore comes from the United States, with smaller quantities from Sweden and Brazil.

Currently Canadian mines produce some 50 million tons of iron ore annually, and exports amount to about three-quarters of that quantity. In the world market, the United States, Western Europe, Britain and Japan are Canada's biggest customers. One of the largest Canadian markets for domestic iron ore is of course the Canadian steel industry.

Looking Ahead

By 1980, Canada's annual production of iron ore is expected to reach 80 million tons. About 66 million tons will be exported, and 14 million tons consumed domestically. To realize these figures, Canada must maintain current markets in the United States, Britain and Western European countries, and increase exports to Japan from new or expanded mines in Québec and Labrador. Factors likely to affect Canadian markets are the rise of Australia as a major supplier of iron ore, and the discovery of extremely large, high grade iron-ore deposits in Brazil. These producers may provide stiff competition in the years ahead.

Prepared for the Mineral Development Sector by Information EMR

For more statistical and general information on Canada's mineral industries see *Handbook Canada*, the *Canada Year Book*, and the *Canadian Minerals Yearbook* available for reference in public libraries across Canada, or for purchase through Information Canada bookshops.

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